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DECEMBER 1, 1986

CHEMICAL & ENGINEERING

NEWS

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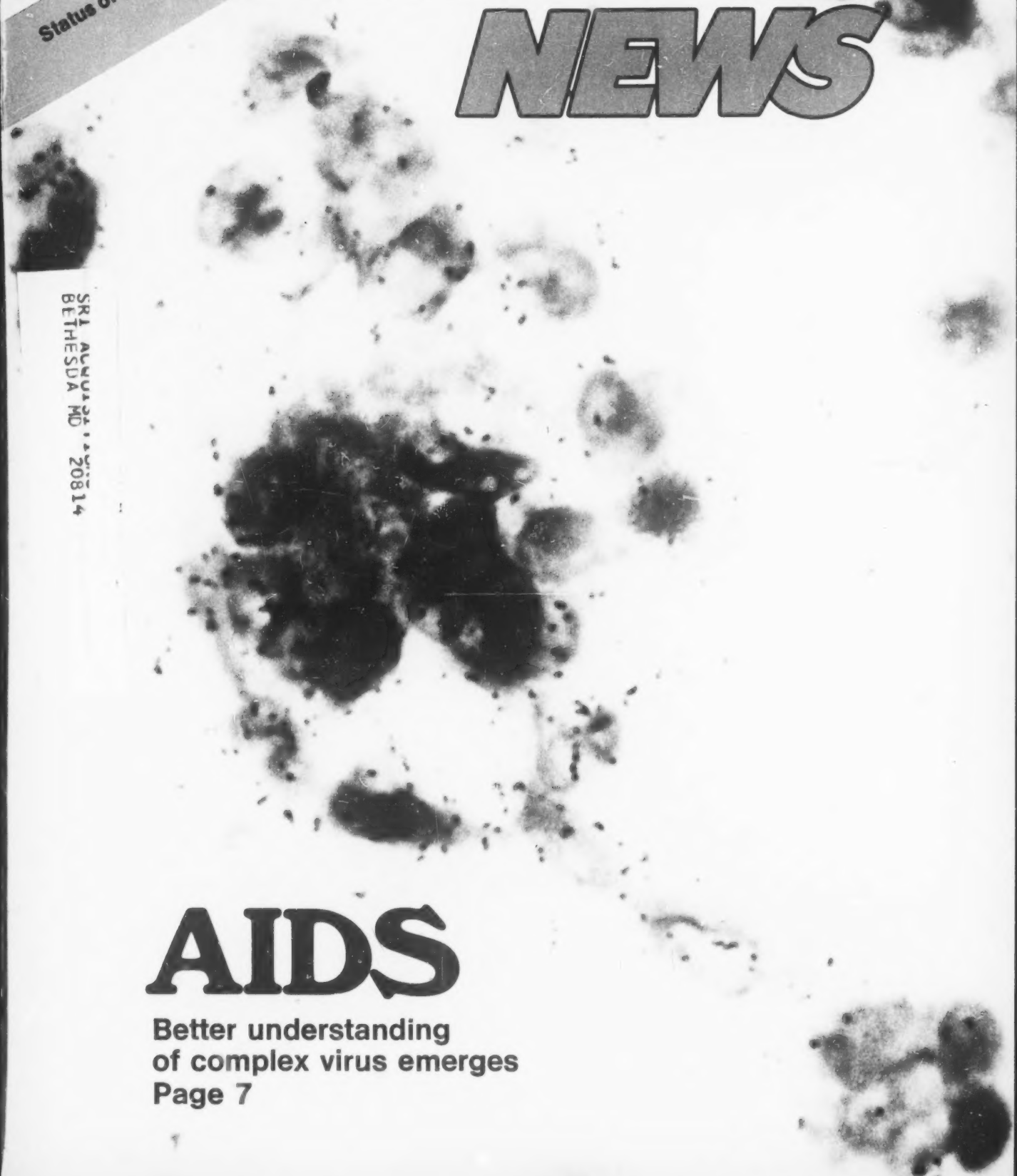

AIDS

Better understanding of complex virus emerges
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CHEMICAL & ENGINEERING
NEWS

Volume 64, Number 48
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DECEMBER 1, 1986

News of the Week

■ **In Bhopal legal battle, India attempts to freeze Union Carbide's assets until extent of liability is determined.** **Page 4**

■ **Chemical productivity increases in the third quarter as a result of cost-cutting measures.** **Page 5**

■ **Caltech radiotelescope, which extends detection range, is ready to begin operating at Mauna Kea, Hawaii.** **Page 5**

■ **New electrical method can detect and locate leaks in hazardous waste impoundment liners.** **Page 6**

■ **EPA issues final guidelines for emissions-trading policy to meet air pollution requirements under Clean Air Act.** **Page 6**

Business

Enrichment of uranium into fuel-grade material is a government monopoly in the U.S., but private enterprise is seeking to enter the market despite past failures. **Page 14**

International Business

Pemex, Mexico's state-owned oil company, plans to spend $2.5 billion over next six years on new petrochemical plants in attempt to reduce petrochemical import bill. **Page 16**

Government

House report on confusing biotechnology regulations recommends retaining current laws, but urges more research to fill information gaps and clearer definition of key terms. **Page 19**

Science

Status of chemical R&D in U.K. is subject of three reports, one of which focuses on need to assess priority areas, the other two compare funding and quality of British science with those in other countries. **Page 22**

Books

According to the authors of "Beyond Oil," energy consumption—not price, capital, and labor—is the major driving force behind the gross national product. **Page 25**

Cover: Multinucleated giant cell infected with human immunodeficiency virus, the AIDS-causing agent. Photo courtesy of National Institute of Allergy & Infectious Diseases and *Science* [**233**, 1089 (1986)]

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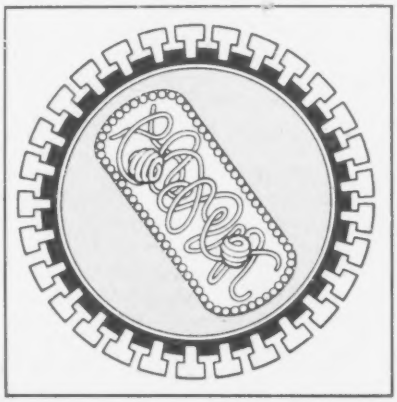

News Focus

AIDS researchers are making progress in delineating the virus that causes AIDS and in their studies of the effects of infection. **Page 7**

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LETTERS

Special appreciation

SIR: This is a note of special appreciation to the hundreds of ACS members who worked on my behalf in the recent ACS presidential campaign and to the more than 19,000 ACS members who supported my candidacy. Your help and support are highly valued and appreciated.

The active, positive campaign by all candidates in the election and the excellent voter participation were, I think, healthy for the society. My heartiest congratulations to Ernest Eliel for a very fine campaign.

The untimely passing of Robert Brasted in early October was a sad loss for us all. His leadership will be missed on the board.

ACS has grown significantly in programs and prestige over the past several years. I solicit member comment and input as we position ourselves to address the many challenges facing chemists and chemistry.

Gordon L. Nelson
ACS President-Elect
Chairman, Polymer Science
University of Southern Mississippi
Hattiesburg

Sodium as a coolant

SIR: In your June 30 issue (page 18) there appeared an article entitled "New Era of Inherently Safe Nuclear Reactor Technology Nears," by Joseph Haggin. In a subsequent letter to the editor, "Nuclear reactor safety," (Sept. 1, page 3) James D. Bushnell raised a number of concerns. This letter specifically addresses his concerns about sodium as a coolant in a liquid-metal cooled reactor (LMR) and the implications of the EBR-II Inherent Safety Demonstration Test.

In an LMR, sodium is used as a coolant because of its excellent nuclear, physical, and chemical properties. Its high boiling point and excellent compatibility with stainless steel make it possible to (1) design an *extremely* reliable primary vessel to contain the reactor and the sodium coolant and (2) design the reactor system to be *inherently* or passively safe for a leak of sodium out of the primary vessel.

In the pool-type design, now largely favored in the rest of the world as well as in the U.S., the highly radioactive reactor system is immersed in a large pool of sodium that is contained in a primary vessel. The system operates at near atmospheric pressure under a blanket of inert argon gas. There are no penetrations in this vessel below the level of sodium. Although stresses in this vessel that could lead to leaks are low, it is contained within a second vessel—the guard vessel. The intervening space between the vessels contains sodium leak detectors and is filled with argon gas. Thus if there were a leak, the sodium would not react with the inert argon atmosphere, and would be detected. If no action were taken, the leaking sodium would fill the space between the primary and guard vessels until its level equilibrated with the level of sodium in the primary vessel. The geometry of the primary and guard vessels is established so that the core is kept covered and can be cooled by natural convection. Thus the system is inherently safe for leaks in the primary tank.

Sodium is also used as a coolant for the intermediate system that transports heat from the primary tank to the nonradioactive steam generators. Bushnell correctly observes that a leak in the steam generator can cause problems, owing to Na-H_2O reaction. This is, in fact, the major real problem area in the design of an LMR power plant. Although EBR-II has never experienced a water-to-sodium leak in more than 22 years of sodium-heated steam generator operation, such leaks have occurred in other plants. None have posed a risk to public safety, since no highly radioactive primary sodium is involved. Indeed, this concern is the major reason for using the intermediate heat transfer system. Since the Na-H_2O reaction takes place between the secondary and steam systems, and the primary system is isolated from these systems, concerns such as "frothing over of the sodium pool, disruption of the pool convection currents," are not realistic.

The use of the large pool of primary sodium as a heat sink during loss of external cooling is an advantage, as Bushnell notes. He then goes on to say "that if the core continued to generate heat at design rate, the sodium would be heated from 650 °F to its boiling point in something like a half hour. . . ." But, as your June 30 article pointed out, in a properly designed, metal-fueled LMR the core would not continue to generate heat at design rate. In the EBR-II loss-of-heat-

Correction

• Nov. 10, page 14: Du Pont's earnings of $322.0 million for third-quarter 1986 were down 7.2% from the year before. Profit margin for third-quarter 1985 was 4.8%.

Mexico's Pemex Continues Building Petrochemical Plants

State-owned oil giant will spend $2.5 billion on petrochemicals over next six years in spite of country's economic problems

Mexico's severe economic problems, its huge foreign debt, and shortage of capital has put a crimp in Pemex's (Petróleos Mexicanos) petrochemical investment plans over the past few years. Yet, even after cutting back on some previously announced projects, the state-owned oil company still estimates that it will spend about $2.5 billion over the next six years for new petrochemical plants.

Antonio Juarez Alvarado, assistant director of petrochemical commercial policy, says that Pemex should have little trouble getting the money. The government, he says, is putting renewed emphasis on certain priority industries. Petrochemicals is one of those industries.

Still, companies in the secondary, or downstream, segment of Mexico's chemical industry that rely on Pemex for their raw materials are taking a wait-and-see attitude. Pemex has a long history of failing to meet demand for its basic petrochemicals. It also has a reputation for not bringing its plants on stream as scheduled.

Shortages are particularly acute in aromatics. And it's not simply a question of inadequate capacity. Pemex hasn't been able to produce as much as it should from existing plants. Through the first nine months of this year, for instance, Pemex produced only 62% of its planned output of xylenes. For benzene, the figure was 88%.

When he recently announced Pemex's petrochemical investment plans, Mario Ramon Beteta, the company's general director, conceded Pemex's poor performance record in the past. "A lot of time has gone by between the time a plant is on stream and when it reaches 100% of capacity," he says. But he promises that Pemex will reduce that time in the future.

Pemex's new petrochemical investment program is the result of a new study estimating Mexico's future basic petrochemical requirements. The proposed schedule, Beteta says, can be slowed or accelerated, depending upon Mexico's general economic condition and the raw material demands of the secondary petrochemical industry.

High on Pemex's priority list is the completion of its Morelos petrochemical complex. Almost, but not quite, a duplicate of the recently completed complex at La Cangrejera, Morelos will sport a 500,000 metric-ton-per-year ethylene unit and a 350,000-metric-ton propylene plant. The ethylene unit is expected to be operating in early 1988; the propylene plant is due on stream later that year.

Morelos will play an important role in reducing Mexico's trade deficit in olefins derivatives. In 1988, Pemex plans to have on stream there a 200,000 metric-ton-per-year ethylene oxide plant. Last year, Mexico imported more than 48,000 metric tons of ethylene oxide.

The country's first polypropylene plant—a 100,000-metric-ton unit—also will go on stream at Morelos in early 1989, making it possible to reduce its import bill $80 million per year. Pemex also plans to continue building plants to produce butadiene (100,000 metric tons a year), acrylonitrile (50,000 metric tons), and isopropyl alcohol (75,000 metric tons) at Morelos. These units will come on stream between 1988 and 1991.

In addition, Morelos will contain Mexico's second high-density polyethylene plant—a 100,000 metric-

Pemex's petrochemical program to add lot of new capacity

Location/product	Planned petrochemical projects: Capacity (thousands of metric tons per year)	Completion date
Morelos		
Ethylene	500	1988
Propylene	350	1988
Ethylene oxide	200	1988
Polypropylene	100	1989
Butadiene	100	a
Acrylonitrile	50	a
Isopropyl alcohol	75	a
Acetaldehyde	150	1989
Polyethylene, high density	100	1988
Polyethylene, linear low density	80	1990
Pajaritos		
Vinyl chloride	200 to 300	b
Salina Cruz		
Benzene	275	b
Toluene	120	b
o-Xylene	30	b
p-Xylene	200	b
Heavy aromatics	29	b
San Martin Texmelucan		
Acrylonitrile	50	1987
Ciudad Madero		
Cumene[c]	20	b
MTBE	30	b
Salamanca		
Olefins[d]	50	1991
Linear paraffins	60	1991
Tula		
Olefins[d]	50	1991
Linear paraffins	60	1991
Lazaro Cardenas		
Ammonia	445	1989
Camargo		
Ammonia	445	1990

a These plants will come on stream between 1988 and 1991. b In the planning stage. c Converted from an old propylene tetramer plant. d Feedstock for biodegradable detergents. **Source:** Pemex (Petróleos Mexicanos)

ton-per-year unit—which is scheduled for completion in 1988. In 1989, a 150,000-metric-ton acetaldehyde plant is expected to be on stream and, in 1990, Mexico's first linear low-density polyethylene unit, with a capacity of 80,000 metric tons per year, likely will be finished at Morelos.

Meanwhile, Pemex is eyeing a vinyl chloride plant at Pajaritos, where it already has 270,000 metric tons of capacity. The proposed new capacity will be between 200,000 and 300,000 metric tons per year, but the final decision on the plant will depend on future demand for polyvinyl chloride products. A lot depends, too, on whether the private sector will build a caustic-chlorine plant near Pajaritos large enough to support the proposed new vinyl chloride unit.

Pemex has modified its plans for a new petrochemical refinery. Originally, the petrochemical refinery was to be built at Lazaro Cardenas, and much of it was to be based on natural gas. Recent studies show that Mexico's natural gas supply won't be so high as Pemex originally thought. As a result, plans for the new petrochemical refinery have been changed.

First, the plant will be geared to oil-based feedstocks. And it will be built in two stages. The first stage will be an aromatics complex to help ease Mexico's aromatics shortage. And it will go up at Salina Cruz instead of Lazaro Cardenas.

The Salina Cruz aromatics complex will produce annually 275,000 metric tons of benzene, 120,000 metric tons of toluene, 200,000 metric tons of *p*-xylene, and 30,000 metric tons of *o*-xylene. In addition, 29,000 metric tons of heavy aromatics will be produced there.

Meanwhile, engineering studies already are under way for the second stage of Pemex's petrochemical refinery. This probably will be built at the original Lazaro Cardenas site and will focus on olefins. The complex will contain still another 500,000 metric-ton-per-year ethylene plant, a 350,000-metric-ton propylene plant, and units to produce ethylbenzene, alpha olefins, polypropylene, propylene oxide, and butadiene. A linear low-density polyethylene unit also had been planned, with a capacity of 240,000 metric tons. This unit, however, was switched over to Morelos and its size reduced to 80,000 metric tons.

Shorter term, Pemex will have on stream next year another 50,000-metric-ton acrylonitrile plant at San Martin Texmelucan. And at Ciudad Madero, the company is converting an old propylene tetramer unit to produce 20,000 metric tons of cumene. At the same site, Pemex also will build a 30,000-metric-ton plant to produce methyl *tert*-butyl ether.

By 1991, Pemex also plans to build a 50,000 metric-ton-per-year plant at Salamanca to produce olefin raw materials for biodegradable detergents and an identical unit at Tula. And 60,000-metric-ton linear paraffin units will go up at these same two sites.

Although Pemex already has almost 2.9 million metric tons a year of ammonia capacity on stream, it is planning for more. Its present investment program calls for completing two 445,000-metric-ton plants—one at Lazaro Cardenas by 1989 and another at Camargo by 1990. By 1993, if demand warrants it, Pemex may consider building still another 445,000-metric-ton ammonia plant.

If Pemex is able to get the funds it needs to fulfill its current petrochemical investment plans, and if it is able to complete the projects on schedule, the company will make a big dent in Mexico's petrochemical import bill. It also will be able to provide the secondary petrochemical industry with the raw materials it will need to become serious exporters.

In the private, secondary sector of the industry, the mood is hopeful. But nobody is taking anything for granted. They have watched similar pronouncements flow out of Pemex before. And they have watched Pemex petrochemical projects fall years behind schedule.

Earl Anderson, New York

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